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IS : 2972 (Part II) - 1979

Indian Standard
SPECIFICATION FOR TEXTILE MOTORS
PART II CARD MOTORS
(First Revision)

UDC 621·313·333·2·025·3 : 677·051·17

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August 1980

AMENDMENT NO. 1 OCTOBER 1987

TO

IS:2972(Part 2)-1979 SPECIFICATION FOR TEXTILE MOTORS

PART 2 CARD MOTORS

(First Revision)

(*Page* 9, *Table* 1):

Col 15 - Substitute 'M24 x 28 Length' *for* 'M24 x 27 Length'.

Col 16 - Substitute 'M10 x 22 Deep' *for* 'M10 x 20 Deep'.

(*Page* 10, *Table* 2):

Col 7 - Substitute $\frac{'124'}{143}$ *for* $\frac{'105'}{143}$.

Col 15 - Substitute 'M24 x 28 Length' *for* 'M24 x 27 Length'.

(*Page* 11, *Table* 3):

Col 15 - Substitute 'M24 x 28 Length' *for* 'M24 x 27 Length'.

(ETDC 15)

Reprography Unit, BIS, New Delhi, India

Indian Standard
SPECIFICATION FOR TEXTILE MOTORS
PART II CARD MOTORS
(First Revision)

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(*Continued on page* 18)

Indian Standard

SPECIFICATION FOR TEXTILE MOTORS

PART II CARD MOTORS

(First Revision)

0. FOREWORD

0.1 This Indian Standard (Part II) (First Revision) was adopted by the Indian Standards Institution on 27 December 1979, after the draft finalized by the Rotating Machinery Sectional Committee had been approved by the Electrotechnical Division Council.

0.2 The requirements of various card motors differ slightly depending upon the type of cards for which these motors are required. The general requirement of card motor is more or less similar to that of a loom motor except that the card motor is required to have a specially high starting torque and it should be liberally designed to withstand a prolonged starting period. Since the inertia of a card drum is very high, the starting period is unduly large. On the other hand, once the card drum is started, the working is continuous and uninterrupted, unlike that of a loom where there is frequent stopping and starting. The power consumption during this period is comparatively very low. The inherent characteristics of a card motor, therefore, are that it should have a higher starting torque than that of any normal motor and it should be capable of withstanding the heavy losses and heating that occur during the prolonged starting period while the dum is being accelerated.

0.3 This standard was first issued in 1964 and covered the requirement of 6-pole and 8-pole card motors. The dimensions and the frame assignments were made only for 6-pole (1 000 rev/min) motors up to 1·5 kW required for driving cards for light fabrics. This revision has been prepared with a view to expanding its scope to cover dimensions and frame assignments for 6-pole motors up to 2·2 kW and 8-pole motors up to 1·5 kW.

0.3.1 Motors driving cards for heavy fabrics, such as woollen and canvas are of higher rating compared with motors driving cards for light fabrics such as cotton silk, rayon, nylon, etc. The other requirements are generally similar.

Based on the experience gained in the country, in this revision, the dimensions and frame assignments are made applicable for motors used on both these applications.

0.3.2 The original standard covered motors with class A, E and B insulation. In this revision, the motors with class F insulation are also added. At the same time, class A has not been deleted as some motor manufacturers in small scale sector are still manufacturing motors with class A insulation.

However, it has not been felt necessary to specify the relationship between output and frame size for class A motors. Frame assignments which were earlier for class A insulated motors are now revised and made applicable to class E and class B insulated motors.

0.4 Since lug-mounted motors are normally used with cradles the dimensions of lug-mounted motors are now with cradles. Foot-mounted motors conforming to IS : 1231-1974* are widely used for card application. Dimensions and frame assignments are, therefore, added for foot-mounted motors. Because of space restriction, the overall dimensions of the motor assume great importance, therefore, maximum overall dimensions are also specified.

0.5 To ensure satisfactory installation and maintenance of induction motors, the recommendations contained in IS : 900-1965† should be followed.

0.6 This standard is one of a series of Indian Standard specifications for motors required by the textile industry, other specifications in the series are:

IS : 2972 (Part I)-1979 Textile motors, Part I Loom motors (*first revision*)

IS: 2972 (Part III)-1979 Textile motors, Part III Spinning frame motors (*first revision*)

0.7 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS : 2-1960‡. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard (Part II) applies to 3-phase squirrel cage induction motors required for driving textile cards generally known as carding engines on medium voltages not exceeding 650 volts and having output rating up to 5·5 kW.

---

*Dimensions of three-phase foot-mounted induction motors (*second revision*).

†Code of practice for installation and maintenance of induction motors (*revised*).

‡Rules for rounding off numerical values (*revised*).

1.2 This standard also specifies the dimensions and frame assignments for class E and B insulated card motors up to 2·2 kW for 6 pole (1 000 rev/min) motors and up to 1·5 kW for 8-pole (750 rev/min) motors.

1.3 The motors covered by this specification have either class A, E and B or F insulation with their associated temperature-rises as outlined in **12** of IS : 325-1978*.

2. TERMINOLOGY

2.1 For the purpose of this standard, definitions given in IS : 1885 (Part XXXV)-1973† shall apply.

3. SITE CONDITIONS

3.1 For the purpose of this standard, the normal site conditions shall be in accordance with **3** of IS : 325-1978*.

4. TYPES OF ENCLOSURES

4.1 The degree of protection to be provided by enclosures shall be IP 44 or superior (totally enclosed) in accordance with IS : 4691-1968‡.

5. METHOD OF COOLING

5.1 The method of cooling shall be IC0041 (totally-enclosed without fan cooling) in accordance with IS : 6362-1971§.

NOTE — Totally-enclosed fan cooled motors may also be used.

6. PREFERRED VOLTAGES, FREQUENCY, OUTPUT AND SPEED

6.1 Preferred Voltage — The preferred rated voltage shall be 415 V.

6.2 Preferred Frequency — The preferred rated frequency shall be 50 Hz.

6.3 Preferred Output — The preferred output ratings shall be 1·1, 1·5, 2·2, 3·7 and 5·5 kW.

NOTE — Motors with output rating 3 kW may also be used.

6.4 Preferred Speeds — The preferred synchronous speeds for the purpose of this standard shall be 1 000 and 750 rev/min corresponding to 6 and 8 pole motors respectively.

---

*Specification for three-phase induction motors (*fourth revision*).

†Electrotechnical vocabulary: Part XXXV Rotating Machinery.

‡Degrees of protection provided by enclosures for rotating electrical machinery.

§Designation of methods of cooling for rotating electrical machines.

7. STANDARD FRAME NUMBERS AND DIMENSIONS

7.1 The frame assignment and the dimensions of the motors shall be as given below:

a) Foot-mounted motors — Table 1, read with Fig. 1.

b) Flat base motors — Table 2, read with Fig. 2.

c) Lug-mounted motors with cradle — Table 3, read with Fig. 3.

NOTE 1 — The frame number output relationship has been specified on the basis that motors are without fan.

NOTE 2 — Threaded shaft extension is provided with a suitable nut and a spring washer.

NOTE 3 — Shaft extension may be provided with either threaded end or a tapped centre hole.

7.2 Position of Terminal Box — The terminal box on a motor should be situated with its centre-line within a sector ranging from the top to 10 degrees below the horizontal centre-line of the motor on the right hand side, when looking at the driving end of the motor.

8. DUTY AND RATING

8.1 For the purpose of this standard, only duty type S_1 (continuous duty) shall be applicable (for details, *see* **9.2** of IS : 4722-1968*).

9. EARTHING

9.1 Earthing of the motor shall be done in accordance with the relevant provisions of IS : 3043-1966†.

10. OVERLOAD

10.1 Card motors shall be capable of withstanding, without injury or permanent deformation, a current 2·5 times the rated full load current for 2 minutes after having attained the temperature-rise according to the rated load, the voltage and frequency being maintainted at their rated values.

10.2 Motors rated in accordance with this standard are not capable of carrying sustained overloads.

11. LIMITS OF VIBRATION

11.1 Unless otherwise specified, the double amplitude of vibrations for the motors shall be within the normal level limits specified in IS : 4729-1968‡.

---

*Specification for rotating electrical machines.

†Code of practice for earthing.

‡Measurements and evaluation of vibration of rotating electrical machines.

12. PERFORMANCE

12.1 Breakaway Starting Torque — With rated voltage and frequency applied to the terminals of the stator, motors shall develop a minimum breakaway starting torque of 350 percent of the full load torque for 6-pole motors, and 275 percent for 8-pole motors.

12.2 Pull-Out Torque — The minimum pull-out torque of the motor shall be 375 percent of the full load torque for 6-pole, and 300 percent for 8-pole motors.

12.3 Operating Conditions — The motors shall be capable of starting the carding engine within a reasonable period and without exceeding the permissible temperature limits as given in **16.3.1**(g) either during starting or on continuous load.

13. TERMINAL MARKINGS

13.1 Terminal markings when used shall be in accordance with IS : 4728-1975*.

14. RATING PLATE

14.1 A rating plate stating the following shall be supplied with each motor:

a) Reference to this standard, that is, ref ISS 2972 (Part II);
b) Induction motor;
c) Name of manufacturer;
d) Manufacturer's number and frame reference;
e) Type of duty;
f) Class of insulation;
g) Frequency in Hz;
h) Number of phases:
j) Rated output in kW;
k) Rated voltage and winding connections;
m) Current, approximate in amperes, at rated output;
n) Speed in revolutions per minute at rated output; and
p) Ambient temperature, when above 40°C.

---

*Terminal marking and direction of rotation for rotating electrical machinery (*first revision*).

14.1.1 The motors may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

15. INFORMATION TO BE GIVEN WITH ENQUIRY AND ORDER

15.1 The general information to be furnished when enquiring for ordering an electric motor is given in Appendix A.

16. TESTS

16.1 General — The tests specified in **16.3** shall normally be carried out at manufacturer's works.

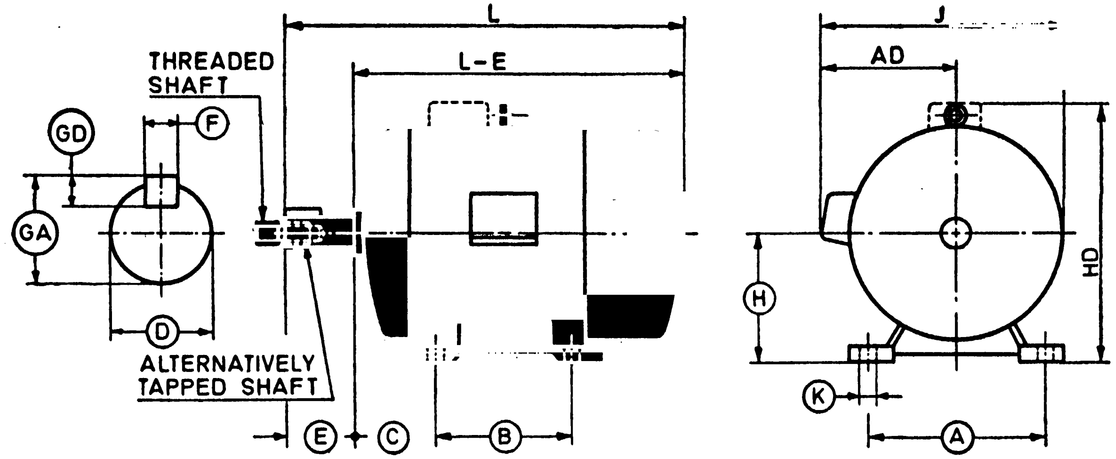
16.2 Test Certificates

16.2.1 Unless otherwise specified when inviting tenders, the purchaser, if so desired by the manufacturer, shall accept manufacturer's certificates as evidence of the compliance of the motor with the requirements of **7**, **10** and **12** of this standard together with type test (*see* **16.3.1.1**) certificate on a motor identical in essential details with the one purchased, together with routine tests on each individual motor. In the case when a batch of 20 or more similar motors is supplied on one order, type tests, as specified, shall be made on one of these motors, if the purchaser so requires.

16.2.2 Certificates of routine tests shall show that the motor purchased has been run and has been found to be electrically and mechanically sound and in working order in all particulars.

16.2.3 If so specified when inviting tenders, tests shall be carried out at the manufacturer's works in the presence of the purchaser or his representative to ensure that the motor complies in every respect with the requirements of **7**, **10**, **12** and **16.3** and to ascertain that the efficiency conforms to the guarantee, if any.

16.2.4 Certificates of all type tests together with a record of any alterations, whether essential or not, which have been made to the motor since the type tests were carried out, shall be kept available by the manufacturer for inspection.



All dimensions in millimetres.

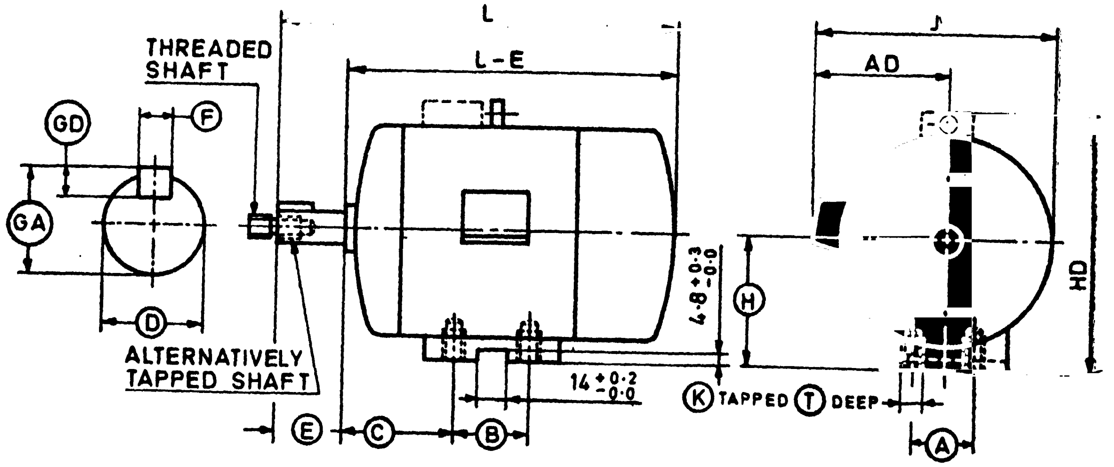
FIG. 1 FOOT-MOUNTED CARD MOTORS

TABLE 1 STANDARD DIMENSIONS OF FOOT MOUNTING CARD MOTORS (CR) WITH CLASS OF INSULATION '*E*' OR '*B*'

(*Clause* 7.1)

FRAME No.	OUTPUT kW		FIXING							SHAFT AND KEY						OVERALL (MAX)*			
	6-Pole	8-Pole	*H*	*A*	*B*	*C*	*K*	*D*		*E*	*F*	*GD*	*GA*	Threaded Shaft	Tapped Shaft	*L—E*	*J*	*HD*	*AD*
								Nom	Tolerance										
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
R 112M	1·1	—	112-0·5	190	140	70	12	28	j6 $^{+0\cdot009}_{-0\cdot004}$	60	8	7	31	M 20 × 22 Length	M 10 × 20 Deep	300	340	320	205
R 132S	1·5	1·1	132-0·5	216	140	89	12	38	k6 $^{+0\cdot018}_{+0\cdot002}$	80	10	8	41	M 24 × 27 Length	M 12 × 28 Deep	360	390	365	230
R 132M	2·2	1·5			178											400			

*The overall dimensions *J* and *AD* are up to the outermost periphery of the motor, including cooling ribs when provided.



All dimensions in millimetres.

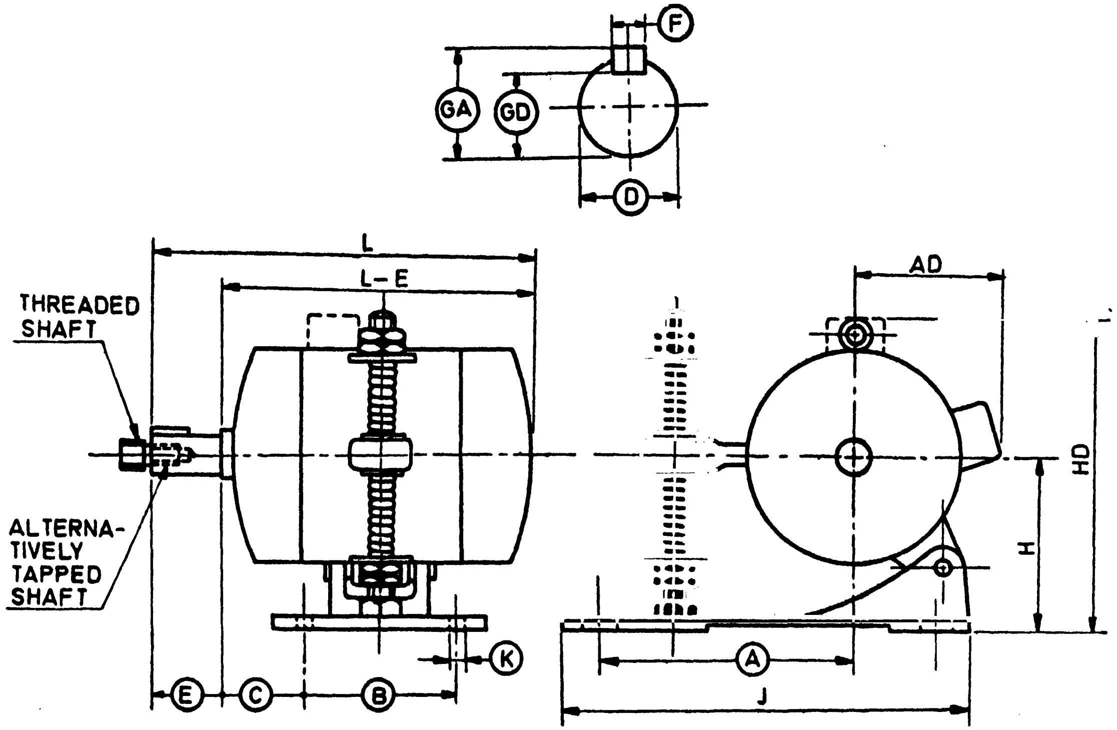
FIG. 2 FLAT BASE MOUNTING CARD MOTORS

TABLE 2 STANDARD DIMENSIONS OF FLAT BASE MOUNTING CARD MOTORS (CP) WITH CLASS OF INSULATION '*E*' OR '*B*'

(*Clause* 7.1)

FRAME No.	OUTPUT kW		FIXING							SHAFT AND KEY						OVERALL (MAX)*			
	6-Pole	8-Pole	*H*	*A*	*B*	*C*	*K* Tapped L × T Deep	*D* Nom	*D* Tolerance	*E*	*F*	*GD*	*GA*	Threaded Shaft	Tapped Shaft	*L—E*	*J*	*HD*	*AD*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
CP 112M	1·1	—	112-0·5	100	70	105	M16×20	28 j6	+0·009 —0·004	60	8	7	31	M 20 × 22 Length	M 10 × 22 Deep	300	340	320	205
CP 132S	1·5	1·1	132-0·5	100	70	105	M16×20	38 k6	+0·018 +0·002	80	10	8	41	M 24 × 27 Length	M 12 × 28 Deep	360	390	362	230
CP 132M	2·2	1·5				143										400			

*The overall dimensions *J* and *AD* are up to the outermost periphery of the motor, including cooling ribs when provided.



All dimensions in millimetres.

FIG. 3 LUG MOUNTING CARD MOTORS WITH CRADLES

TABLE 3 STANDARD DIMENSIONS OF LUG MOUNTING CARD MOTORS WITH CARDLES (CL) WITH CLASS OF INSULATION '*E*' OR '*B*'

(*Clause* 7.1)

FRAME No.	OUTPUT, kW		FIXING							SHAFT & KEY						OVERALL (MAX)†			
	6-Pole	8-Pole	*H**	*A*	*B*	*C*	*K*	*D*		*E*	*F*	*GD*	*GA*	Threaded Shaft	Tapped Shaft	*L—E*	*J*	*HD*	*AD*
								Nom	Tolerance										
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
CL 112M	1·1	—	183	324	168	56	19	28	j6 $^{+0{\cdot}009}_{+0{\cdot}004}$	60	8	7	31	M 20 × 22 Length	M 10 × 22 Deep	300	415	388	205
CL 132S	1·5	1·1	199	363	168	75	19	38	k6 $^{+0{\cdot}018}_{+0{\cdot}002}$	80	10	8	41	M 24 × 27 Length	M 12 × 28 Deep	360	553	429	230
CL 132M	2·2	1·5				93										400			

*The dimension '*H*' is not a rigid dimension. It is for guidance only.

†The overall dimensions *J* and *AD* are up to the outermost periphery of the motor, including cooling ribs when provided.

16.3 Classification of Tests

16.3.1 *Type Tests* — The following shall constitute the type tests:

a) Measurement of stator resistance;

b) No-load running of motor and reading of voltage, current, power input and speed;

c) Reduced voltage running up test at no-load in each direction of rotation with $1/\sqrt{3}$ of the rated line voltage applied to the motor;

d) Locked-rotor readings of voltage, current, power input and value of torque of motor;

NOTE — This test may be made at a reduced voltage.

e) Full-load reading of voltage, current, power input and slip;

f) Momentary overload test;

g) Temperature-rise test (*see* **22** of IS : 325-1978*);

h) High-voltage test (*see* **23** of IS : 325-1978*);

j) Insulation-resistance test, both before and after the high voltage test (*see* **24** of IS : 325-1978*);

NOTE — For test methods covered in this standard, reference may be made to IS : 4029-1967†.

16.3.1.1 It is recommended that reports of type tests be made in the form given in Appendix B.

16.3.2 *Routine Tests* — The following shall constitute the routine tests:

a) Insulation resistance test (before high voltage test only) (*see* **24** of IS : 325-1978*);

b) High voltage test (*see* **23** of IS : 325-1978*);

c) No-load running of motor and reading of current in the three phases and voltage;

d) Locked-rotor readings of voltage, current and power input at a suitable reduced voltage; and

e) Reduced voltage running up test at no-load to check the ability of the motor to run up to full speed on no-load in each direction of rotation with $1/\sqrt{3}$ of the rated line voltage applied to the stator terminals.

---

*Specification for three-phase induction motors (*fourth revision*).

†Guide for testing three-phase induction motors.

APPENDIX A

(*Clause* 15.1)

INFORMATION TO BE GIVEN WITH ENQUIRY AND ORDER

When enquiring for and ordering an electrical motor to comply with this standard the following particulars should be supplied:

1) Site and operating conditions,
2) The reference to this standard, that is, Ref ISS : 2972 (Part II);
3) The type of enclosure;
4) The type of duty;
5) Frequency in Hz;
6) Number of phases;
7) Mechanical output in kW;
8) Rated voltage;
9) Class of insulation;
10) Speed in revolutions per minute, approximate, at the rated output;
11) Direction of rotation;
12) The maximum temperature of the cooling air in the place in which the motor is intended to work in ordinary service;
13) Maximum permissible temperature-rise of motor required, if different from this standard;
14) The altitude of the place in which the motor is intended to work in ordinary service, if it exceeds 1 000 m;
15) If a motor is required to operate between various limits of voltage, current, frequency or speed, the corresponding value of the voltage, current, frequency and speed, respectively;
16) System of earthing, if any, to be adopted;
17) Particulars of tests required and where they are to be carried out;
18) Details of shaft extension required;

19) Method of starting to be employed;

20) Breakaway, torque in terms of the rated-load torque and the corresponding breakaway starting current which may be taken from the supply with the starting apparatus in circuit; and

21) Nature of load and any information regarding the driven machine which has a bearing upon the torque required during the accelerating period, the kinetic energy of the moving parts to be accelerated, and the number of starts during a specified period;

22) Value of GD^2 and speed characteristics of the driven equipment;

23) a) Mounting details, such as flat base or lug mounting, and

    b) Details of drive, such as belt or gear or clutch;

24) a) Particulars of cable connections required, and

    b) Direction of cable entry; and

25) Any specific requirement.

Attention is directed to the duty rating of switching starter as specified in IS : 8544 (Part I)-1977*

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*Specification for motor starters of voltage not exceeding 1 000 V: Part I Direct-on-line ac starters.

APPENDIX B

(*Clause* 16.3.1.1)

FORM FOR TYPE-TEST REPORT OF THREE-PHASE CARD MOTOR (SQUIRREL-CAGE)

Name and Address of the Manufacturer
As per ISS : 2972 (Part II)

Purchaser...............
Purchaser's Order No........ ......

Certificate No...................
Order Acceptance No...... ....

Nameplate Data

kW Output	Synchronous Speed RPM	Full Load RPM	Phase Connection	Hz	Volts	Amps Full Load	Enclosure	Rating	Frame	Temperature Rise	Class of Insulation

Test Characteristics

Loading Condition	Volts	Amperes	Watts	Percent Slip	Load	Power Factor		Efficiency	
						Guaranteed	Test	Guaranteed	Test
No Load					—				
Load					$\frac{1}{2}$				
					$\frac{3}{4}$				
					$\frac{1}{1}$				

Temperature-test Run

Conditions of Test						Temperature Rise in °C Stator	
Hours Run	Line Volts	Line Amperes	Watts Input	Calculated Output	Cooling Air in degrees Celsius	Core by thermometer	Windings by Resistance or Thermometer

Breakaway Torque and Starting Current			INSULATION AND HIGH VOLTAGE TEST	
Locked Rotor Torque in Nm with Volts Applied	Breakaway Starting Current (Locked Rotor) with Volts Applied	Locked-Rotor Watts with Volts Applied	Insulation Resistance	High Voltage

Resistance Per Phase
Stator
............ohms at......°C

The motor runs up to full load speed at in load on both directions of rotation with......Volts applied to stator.

Momentary overload for 2 minutes.........Test O.K. Approved by.........

Tests conducted on Machine No.......... Date..........

Tested by.................on...................

(*Continued from page* 2)

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INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

QUANTITY	UNIT	SYMBOL
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

QUANTITY	UNIT	SYMBOL
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

QUANTITY	UNIT	SYMBOL	DEFINITION
Force	newton	N	$1\ \text{N} = 1\ \text{kg.m/s}^2$
Energy	joule	J	$1\ \text{J} = 1\ \text{N.m}$
Power	watt	W	$1\ \text{W} = 1\ \text{J/s}$
Flux	weber	Wb	$1\ \text{Wb} = 1\ \text{V.s}$
Flux density	tesla	T	$1\ \text{T} = 1\ \text{Wb/m}^2$
Frequency	hertz	Hz	$1\ \text{Hz} = 1\ \text{c/s}\ (\text{s}^{-1})$
Electric conductance	siemens	S	$1\ \text{S} = 1\ \text{A/V}$
Electromotive force	volt	V	$1\ \text{V} = 1\ \text{W/A}$
Pressure, stress	pascal	Pa	$1\ \text{Pa} = 1\ \text{N/m}^2$

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